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BIME-008

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

00688

June, 2016

BIME-008 : MACHINE DESIGN – I

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted. Use of Design Data Book is permitted. Assume missing data suitably.*

1. Design the longitudinal joint for a 1·25 m diameter steam boiler to carry a steam pressure of 2·5 N/mm^2. The ultimate strength of the boiler plate may be assumed as 420 MPa, crushing strength as 650 MPa and shear strength as 300 MPa. Take the joint efficiency as 80%. Sketch the joint with all the dimensions by assuming suitable scale. Take the factor of safety suitably. *14*

2. Determine the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded to another plate by means of

(a) a single transverse weld, and

(b) double parallel fillet welds when the joint is subjected to variable loads. *14*

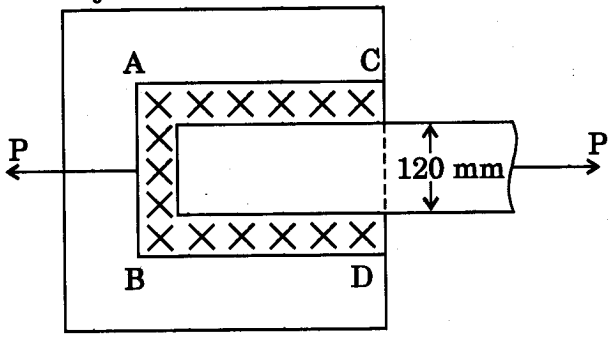

Figure 1

3. Design a cotter joint to connect a piston rod to the cross-head of a double acting steam engine. The diameter of the cylinder is 300 mm and the steam pressure is 1 N/mm^2. The allowable stresses for the material of cotter and piston rod are as follows : *14*

σ_t = 50 MPa; τ = 40 MPa; and σ_c = 84 MPa.

4. Design and draw a protective type of cast-iron flange coupling for a steel shaft transmitting 15 kW at 200 rpm and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for the shaft and key, and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast-iron is 14 MPa. *14*

5. (a) Show by neat sketches the various ways in which a riveted joint may fail.

(b) What is the difference between caulking and fullering ? Explain with the help of neat sketches. *6+8*

6. A screw jack carries a load of 22 kN. Assuming the coefficient of friction between screw and nut as 0·15, design the screw and nut. Neglect collar friction and column action. The permissible compressive and shear stresses in the screw should not exceed 42 MPa and 28 MPa respectively. The shear stress in the nut should not exceed 21 MPa. The bearing pressure on the nut is 14 N/mm^2. Also determine the effort required at the handle of 200 mm length in order to raise and lower the load. What will be the efficiency of the screw ? *14*

7. Write short notes on any ***two*** of following : *7+7*

(a) Reverse engineering and its applications

(b) Effect of stress concentration with examples

(c) Pneumatic presses and their applications